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NATIONAL DAM SAFETY PROGRAM. WATERVLIET LOWER DAM (INVENTORY NU--ETC(U)
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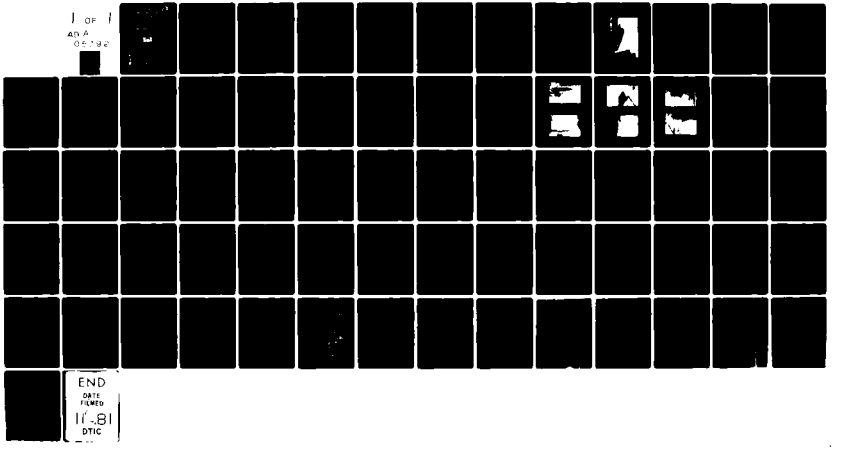

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LOWER HUDSON RIVER BASIN

WATERVLIET LOWER DAM

ALBANY COUNTY, NEW YORK
INVENTORY NO. N.Y. 1357

PHASE I INSPECTION REPORT
NATIONAL DAMS SAFETY PROGRAM

NEW YORK DISTRICT CORPS OF ENGINEERS
FEBRUARY 1981

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A105	3. RECIPIENT'S CATALOG NUMBER 142
4. TITLE (and Subtitle) Phase I Inspection Report Watervliet Lower Dam Lower Hudson River Basin, Albany County, N.Y. Inventory No. 1357		5. TYPE OF REPORT & PERIOD COVERED Phase I Inspection Report National Dam Safety Program
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) (10) GEORGE KOCH		8. CONTRACT OR GRANT NUMBER(s) (15) DACW51-79-C-0001
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(6) National Dam Safety Program. Watervliet Lower Dam (Inventory Number NY. 1357), Lower Hudson River Basin, Albany County, New York. Phase I Inspection Report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dam Safety	Watervliet Lower Dam
National Dam Safety Program	Albany County
Visual Inspection	Lower Hudson River Basin
Hydrology, Structural Stability	

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report provides information and analysis on the physical condition of the dam as of the report date. Information and analysis are based on visual inspection of the dam by the performing organization.

The examination of documents and visual inspection of the Watervliet Lower Dam and appurtenant structures did not reveal conditions which constitute a hazard to human life or property.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

The discharge capacity of the spillway is inadequate for all storms in excess of 77% of the PMF (Probable Maximum Flood). During the ½ PMF event, the maximum water surface will be 4.4 feet below the top of dam. However, the dam will be overtopped by 2.0 feet during the full PMF; therefore the spillway is assessed as "Inadequate".

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
WATERVLIET LOWER DAM
I.D. NO. N.Y.1357
DEC #226A-1412 LOWER HUDSON RIVER BASIN

TABLE OF CONTENTS

Phase I Inspection Report
National Dam Safety Program

Name of Dam:	Watervliet Lower Dam (I.D. No. NY 1357)
State Located:	New York
County Located:	Albany
River:	Dry River (tributary to Lower Hudson River)
Date of Inspection:	November 7, 1980

ASSESSMENT

The examination of documents and visual inspection of the Watervliet Lower Dam and appurtenant structures did not reveal conditions which constitute a hazard to human life or property.

The discharge capacity of the spillway is inadequate for all storms in excess of 77% of the PMF (Probable Maximum Flood). During the ½ PMF event, the maximum water surface will be 4.4 feet below the top of dam. However, the dam will be overtopped by 2.0 feet during the full PMF; therefore the spillway is assessed as "Inadequate".

The following problems were observed which require remedial action within one year of notification to the owner:

1. Clean the deteriorated concrete and repair those areas where significant concrete is needed and where reinforcing bars are exposed.
2. Repair the construction joints and cracking of the spillway.
3. Remove the debris and sediment from the vicinity of the intakes and the downstream channel.
4. Consider removal of penstock.
5. Remove the tree and brush growth from the abutments upstream area and downstream channel. Provide a program of periodic cutting at these locations.
6. Provide a program of periodic inspection and maintenance of the dam and appurtenances including periodic removal of sediment and debris. Document this information for future reference.
7. Develop an emergency action plan for notification of downstream residents and the proper governmental authorities.

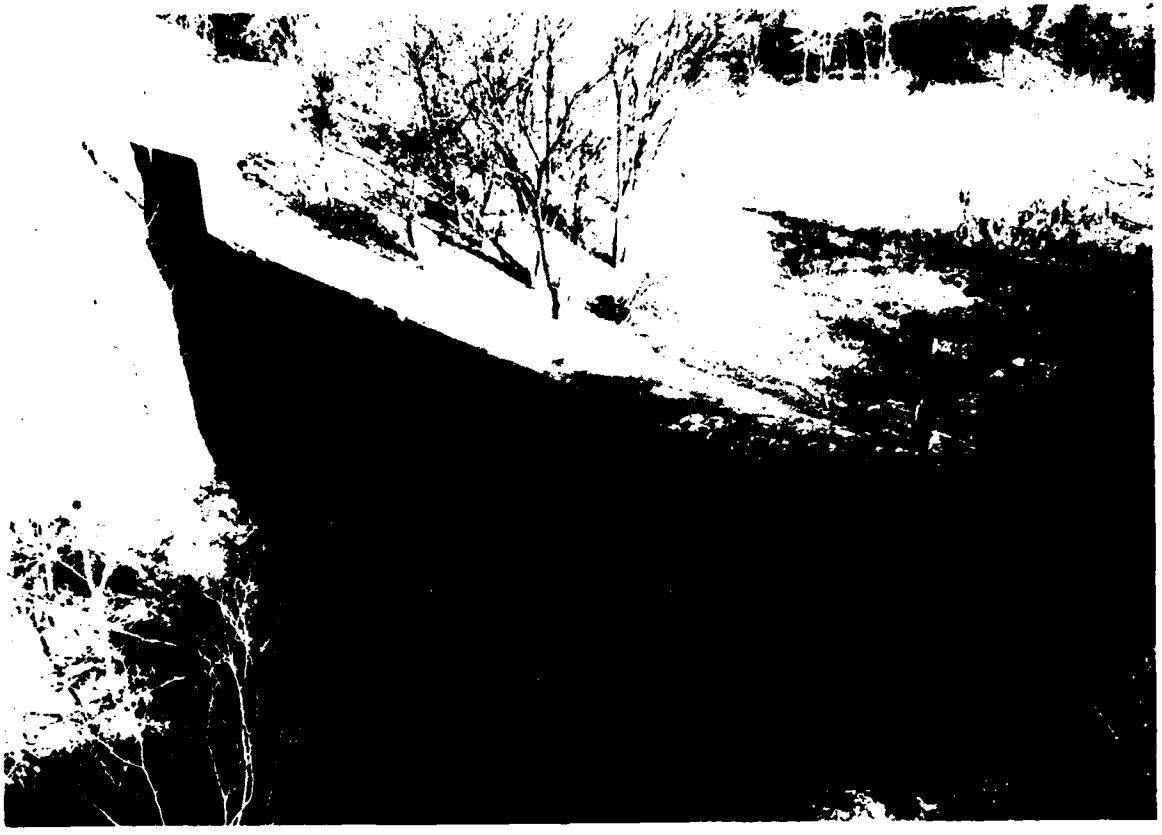


PHOTO #1

Watervliet Lower Dam Overview.

Phase I Inspection Report
National Dam Safety Program
Watervliet Lower Dam I.D. No. NY 1357
DEC # 226A-1412 Lower Hudson River Basin

SECTION 1: PROJECT INFORMATION

1.1 GENERAL

a. Authority

The Phase I inspection reported herein was authorized by the Department of the Army, New York District, Corps of Engineers, to fulfill the requirements of the National Dam Inspection Act, Public Law 92-367.

b. Purpose of Inspection

Evaluation of the existing conditions of the subject dam to identify deficiencies and hazardous conditions, determine if they constitute hazards to human life and property and recommend measures where necessary.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances

The Watervliet Lower Dam is a concrete structure of the Amburson design, founded on rock. It is 108 feet in total length with a 70 feet long overflow spillway section. The primary spillway is a 24 inch orifice with a crest elevation equal to the toe of the dam. Another 22 inch outlet is available but inoperable, and the intake is buried in sediment. The normal water surface is approximated by the elevation of the crest of the 24 inch orifice, leaving the reservoir relatively dry during normal conditions. The overflow section has 5.5 feet of head available before overtopping of the dam will occur.

b. Location

The dam is located on Dry River, tributary to the Lower Hudson, west of Watervliet, Albany County, New York.

c. Size

The dam is 27 feet high and impounds approximately 53 acre feet at top of dam. The normal water surface elevation is kept at the toe of the dam. The dam is therefore classified as "small in size" (25 to 40 feet).

d. Hazard Classification

The dam is classified as high hazard due to its location in relation with the City of Watervliet. The downstream channel is confined by some low lying homes and converts into a closed system within the city.

e. Ownership

The dam is owned and maintained by the City of Watervliet, New York. Mr. Jim Davin, Supt. D.P.W., was our contact with the owner. He can be contacted at City Hall, Watervliet, NY (518) 270-3821.

f. Purpose of the Dam

The dam was designed as a storm water detention dam.

g. Design and Contruction History

The dam was constructed in 1912 by Leary and Morrison Co. and designed by Fred Hoadley, Worcester, MA, for Solomon, Norcross & Keis, Watervliet, New York. There have been no recorded changes to this structure since original completion.

h. Normal Operating Procedures

All releases from the Lower Reservoir are passed through the orifice and conduit. The system involves no operation. Maintenance is on an "as needed" basis.

1.3 PERTINENT DATA

a. Drainage Area (sq. mi.)	3.04
b. Height of Dam (ft.)	27.
c. Discharge at Dam Site (cfs.)	
Spillway at Overflow Crest	57.
Total at Top of Dam	3519.
d. Elevations (ft., U.S. G.S.)	
Top of Dam	111.5
Overflow Spillway Crest	106.0
Primary Spillway Crest	92.0
e. Storage (acre ft.)	
Top of Dam	53.0
Normal	0.0

f. Dam

Type: Buttressed concrete slab of the Amburson design.

Length (ft.)	108.
Upstream slope	1.3:1

g. Spillway

Type: Concrete intake congruent to the upstream slope of the structure, controlled by 24 inch orifice. Secondary overflow section.

Secondary Crest Length (ft.):	70.3
Depth (ft.)	5.5

SECTION 2: ENGINEERING DATA

2.1 GEOLOGY

The Watervliet Lower Dam is located in the Hudson-Mohawk Lowlands, physiographic province of New York State. The general topography of this province resulted from erosion along outcrop belts of weak rocks. Most of the province has Low relief and elevation. Bedrock in the vicinity of the dam is Ordovician Shale (500 to 435 million years ago) which has been exposed by the southward and westward stripping off of Silvrian and Devonian Limestones.

Glacial cover has resulted from deposition during the Wisconsin glaciation, approximately 11,000 years ago.

The "Preliminary Brittle Structures Map of New York" developed by Yngvar W. Isachsen and William G. McKendree (dated 1977) indicates the presence of a gravity slide (rock into sediments) of the Early Taconian orogenic age, located in the watershed above the dam.

2.2 SUBSURFACE INVESTIGATION

No subsurface investigation could be located for the design of the structure. The "General Soil Map of New York State", prepared by Cornell University Agriculture Experiment Station, indicates that the surficial soils in the vicinity of the dam are the Hudson series of glacial Lake and marine sediment origin. These soils were formed on Lacustrine bottom sediments, and consist of varied silt, sand and clay. The permeability is generally very slow. The depth to bedrock is variable. Bedrock was observed at the abutments and along the upstream and downstream channels.

2.3 DAM AND APPURTENANT STRUCTURES

The dam was designed by Fred M. Houdley, Consulting Enginner, Worcester, MA. The engineers in charge were Solomon, Norcross, & Keis, Watervliet, NY. The plans, dated April 1912, have been included in Appendix F. The dam is an upstream concrete slab of the Amburson type, supported on and keyed into bedrock at the abutments and upstream toe.

2.4 CONSTRUCTION RECORDS

No construction information was available.

2.5 OPERATION RECORD

No operation records are maintained for the dam.

2.6 EVALUATION OF DATA

The data presented in this report has been compiled from information obtained from Mr. Jim Davin, Superintendent, Department of Public Works, Watervliet, NY and the NYS Department of Environmental Conservation files. This information appears adequate and reliable for Phase I Inspection purposes

SECTION 3: VISUAL INSPECTION

3.1 FINDINGS

a. GENERAL

Visual inspection of Watervliet Lower Dam and the surrounding watershed was conducted on November 7, 1980. The weather was partly cloudy and the temperature ranged in the forties. The water level at the time of the inspection was approximating the inlet elevation of the reservoir drain, and only a small stream of water was apparent in the upstream area.

b. Dam and Spillway

The dam is of the Amburson type, the majority of the length performing as a spillway. The following problem are as were observed:

1. Reinforcing bars were exposed on the downstream edge of the spillway crest, on the horizontal concrete braces at the downstream edge of the buttresses, on the vertical concrete member at the extreme left end of the dam, and on the upstream face of the spillway approximately 20 feet right of the center.

2. Concrete surfaces, while generally in good condition, exhibited some deterioration, particularly in the vicinity of the exposed rebars, estimated to be a maximum of 3 inches.

3. The construction joints and joint material are deteriorated slightly.

4. The intake of the 22 inch drain pipe, which leads to the penstock, and the rectangular intake on the upstream face of the spillway are covered with debris and sediment.

5. Several cracks were observed on the bottom of the spillway slab.

6. The penstock of the 22 inch intake is encased in concrete in the immediate downstream area. The pipe is substantially deteriorated and leaking.

7. Extensive tree growth was observed in the vicinity of the abutments.

c. Downstream Channel

The downstream channel is the natural stream channel of this unnamed tributary. Debris and extensive tree and brush growth was observed below the dam. The rock abutants and side slopes of the channel are very steep. Bedrock was also exposed in the downstream area in the vicinity of the dam.

d. Reservoir

Extensive sediments were observed near the upstream toe of the dam. Considerable tree growth was also noted on the steep side slopes of the upstream area in the vicinity of the dam.

e. Reservoir Drain

There are two intakes which function such that little water is impounded in the upstream area. The 22 inch penstock intake is inoperable, but the 24 inch orifice outlet remains open keeping the normal water surface at the toe of the dam.

3.2 EVALUATION OF OBSERVATIONS

The problem areas observed during the inspection and the recommended remedial actions are as follows:

1. Concrete deterioration of the dam has progressed to the point the reinforcing steel is exposed. These areas must be repaired as soon as possible.

2. Concrete deterioration at other locations, i.e. crest and abutments was noted. These areas must also be repaired.

3. The construction joints and joint material are deteriorated and require repair.

4. Cracks were observed on the bottom side of the spillway slab, and must be repaired.

5. Debris and sediment was noted in the vicinity of the intakes and the downstream channel. This material must be cleaned out as soon as possible. Periodic clean ups will be required in the future.

6. The penstock is deteriorated and leaking. In order to prevent clogging of the drain system, consideration should be given to its complete removal.

7. Extensive tree and brush growth was noted in the downstream channel, at the abutments of the dam and in the immediate upstream area. This vegetation must be removed and a program of periodic cutting instituted.

8. Provide a program of periodic inspection and maintenance of the dam and appurtences. Document this information for future reference. Also develop an emergency action plan for notification of downstream residents.

SECTION 4: OPERATION AND MAINTENANCE PROCEDURES

4.1 PROCEDURES

The normal water surface is approximated by the invert elevation of the 22 inch diameter drain pipe, the result being that little water is impounded on the upstream side of the structure. Normal flows are discharged through the 24 inch orifice. Extreme flows are discharged over the spillway.

4.2. MAINTENANCE OF THE DAM

Maintenance of the dam is provided by the owner, the City of Watervliet, NY. Maintence of the dam is not considered satisfactory as evidenced by the concrete deterioration, sediment and debris blocking the intakes, tree and brush growth, deterioration of construction joints, cracking of the spillway slab and deteriorated penstock.

4.3 WARNING SYSTEM

There is no warning system in affect or in preparation.

4.4 EVALUATION

The dam and appurtenances have been maintained in unsatisfactory condition as noted in "Section 3: Visual Inspection".

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 DRAINAGE AREA CHARACTERISTICS

The Watervliet Lower Dam is located on Dry River, tributary to the Lower Hudson. The area of the watershed commanded by the dam is 3.04 square miles. The drainage area is split by the Watervliet Upper Dam, which controls the upper 2.88 sq. miles. The drainage paths are well defined but the slopes are moderate. Some of the basin is developed.

5.2 ANALYSIS CRITERIA

The analysis of the spillway capacity of the dam and storage of the reservoir was performed using the Corps of Engineer's HEC-1 computer model. The unit hydrograph was defined by the Snyder Synthetic Unit Hydrograph method, and the Modified Puls routing procedure was incorporated. The Probable Maximum Precipitation (PMP) was 20.5 inches (24 hours, 200 sq. miles) from Hydrometerological Report # 33 in accordance with recommended guidelines of the Corps of Engineers. Several floods were selected for analysis including the 50 and 100% of the Probable Maximum Flood (PMF). The PMF inflow of 5630 cfs was routed through the reservoir resulting in an equal outflow due to the minimal amount of storage in the lower reservoir.

5.3 SPILLWAY CAPACITY

The primary spillway of the Lower Watervliet Dam is a 24 inch orifice dropping into a 48 inch outlet conduit. Crest elevation is equivalent to the sediment accumulation in the reservoir (approximately 8 feet above actual toe of the structure. The intake to the now inoperable 22 inch penstock is completely buried in the sediment (see plans). The structure has an overflow section 14' above the orifice crest which is 70.3 feet in length. The available head on the overflow weir before overtopping will occur is 5.5 feet. The capacity at the crest of the overflow section is 57. cfs.; at the top of dam, the total capacity is 3519. cfs.

5.4 RESERVOIR CAPACITY

The reservoir capacity, as previously stated, is 0.0 acre feet at spillway crest, 20. acre feet at secondary spillway crest, and 53. acre feet at top of dam. Surcharge storage between spillway crest and top of dam is equivalent to 0.34 inches to runoff.

5.5 FLOODS OF RECORD

There are no gaging stations on Dry River nor are there any accounts of high flows or levels.

5.6 OVERTOPPING POTENTIAL

The maximum capacity of the spillway before overtopping occurs is 3519. cfs. This combined with the large amount of upstream regulation due to the upper reservoir will safely pass 77% of the PMF. The maximum outflow at 1/2 the PMF will be 461 cfs. The dam will be overtopped by 2.0 feet during the full PMF and will result in an outflow of 5827 cfs.

5.7 EVALUATION

The Waterylet Lower Dam will safely pass 77% of the PMF. By the Corps of Engineers Screening Criteria, it is considered inadequate.

SECTION 6: STURCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observation

No signs of major distress were observed in connection with the dam. Cracking, concrete deterioration and exposure of reinforcing bars does have the potential for the development of hazardous conditions if these areas are left uncorrected.

b. Design and Construction Data

No design or construction data could be located concerning the structural stability of the dam.

c. Post Construction Changes

No post constructions changes were instituted.

6.2 STRUCTURAL STABILITY ANALYSIS

A structural stability analysis was conducted for the dam. The results of this analysis are as follows:

Case	Description of Loading Conditions
1	Normal Operating Conditions, Reservoir at crest of dam no tail water.
2	1/2 PMF Event (El. 107) tailwaters 0.5 feet
3	PMF Event (El. 113.5) tailwater 3.0 feet

Note: since the reservoir is floodwater retarding no ice land is imposed on the dam, and seismic analysis is not applicable.

Case	Factor of Safety Overturning	Location of Resultant from toe	Factor of Safety Sliding
1	5.37	20.8	3.20
2	4.83	20.3	2.97
3	2.94	17.0	2.03

The location of the middle 1/3 ranges from 12.3 to 24.7 feet from the toe.

This analysis indicates that the structure has factors of safety in excess of those recommended by the Corps of Engineers. Therefore, no further analysis is required at this time.

SECTION 7: ASSESSMENT/RECOMMENDATIONS

7.1 ASSESSMENT

a. Safety

The Phase I Inspection of Watervliet Lower Dam did not reveal any conditions which constitute a hazard to human life or property. The dam is not considered to be unstable. The dam has a number of problem areas which require remedial attention.

b. Adequacy of Information

The information reviewed is considered adequate for Phase I Inspection purposes.

c. Need for Additional Investigation

No further investigations are required at this time.

d. Urgency

The areas listed below requiring remedial action should be initiated within 3 months and completed within 1 year from notification to the owner.

7.2 RECOMMENDATIONS

1. Clean the deteriorated concrete and repair those areas where significant concrete is needed and where reinforcing bars are exposed.

2. Repair the construction joints and cracking of the spillway.

3. Remove the debris and sediment from the vicinity of the intakes and the downstream channel.

4. Consider the removal of the penstock.

5. Remove the tree and brush growth from the abutants upstream area and downstream channel. Provide a program of periodic cutting at these locations.

6. Provide a program of periodic inspection and maintenance of the dam and apportanances including periodic removal of sediment and debris. Document this information for future reference. Also develop an emergency action plan for notification of downstream residents and the proper governmental authorities.

APPENDIX A

PHOTOGRAPHS

PHOTO #2
Intake to Primary Spillway
Note Debris and Sediment Accumulation.

PHOTO #3
48" SPILLWAY OUTLET

PHOTO #4
Dam and Overflow Spillway from Right Abutment.
Note deteriorated construction joints and concrete.

PHOTO #5
Right Abutment from downstream view.

PHOTO #6
Channel immediately downstream of dam.

PHOTO #7
Channel just above Watervliet City limits.

APPENDIX B

VISUAL INSPECTION CHECKLIST

93-15-3(9/80)

VISUAL INSPECTION CHECKLIST

1) Basic Data

a. General

Name of Dam WATERVLIET LOWER DAM

Fed. I.D. # NY 1357 DEC Dam No. 226A - 1412

River Basin Lower Hudson

Location: Town Colonie County ALBANY

Stream Name DRY RIVER

Tributary of LOWER HUDSON

Latitude (N) 42°49.2′ Longitude (W) 73°42.7′

Type of Dam CONCRETE GRAVITY - AMBURSEN DESIGN

Hazard Category high

Date(s) of Inspection NOV. 7, 1980

Weather Conditions cloudy, 40's

Reservoir Level at Time of Inspection invert of principle spillway

b. Inspection Personnel R. M'CARTY, J. VEITCH, R. DURRIN
J. DAVIN

c. Persons Contacted (Including Address & Phone No.)

JIM DAVIN
SUPT. D.P.W
CITY HALL, WATERVLIET NY
(518) 270-3821

d. History:

Date Constructed 1912 Date(s) Reconstructed

Designer FRED HOADLEY, WORCESTER MA.

Constructed By LEARY & MORRISON CO.

Owner CITY OF WATERVLIET.

93-15-3(9/80)

2) Embankment

a. Characteristics

(1) Embankment Material CONCRETE

(2) Cutoff Type CONCRETE

(3) Impervious Core —

(4) Internal Drainage System —

(5) Miscellaneous SOME CRACKING

b. Crest

(1) Vertical Alignment good

(2) Horizontal Alignment good

(3) Surface Cracks some

(4) Miscellaneous —

c. Upstream Slope

(1) Slope (Estimate) (V:H) ~~1~~ 1.3:1v

(2) Undesirable Growth or Debris, Animal Burrows BRUSH growth UP & downstream

(3) Sloughing, Subsidence or Depressions None

(4) Slope Protection ON Rock

(5) Surface Cracks or Movement at Toe No

d. Downstream Slope

(1) Slope (Estimate - V:H) N/A

(2) Undesirable Growth or Debris, Animal Burrows growth of brush trees etc.

(3) Sloughing, Subsidence or Depressions None

(4) Surface Cracks or Movement at Toe Some cracking No movement

(5) Seepage Minor leakage (through penstock)

(6) External Drainage System (Ditches, Trenches; Blanket) None

(7) Condition Around Outlet Structure good

(8) Seepage Beyond Toe None.

e. Abutments - Embankment Contact

Appears good.

93-15-3(9/80)

(1) Erosion at Contact None

(2) Seepage Along Contact None.

3) Drainage System

a. Description of System orifice - into 48" DISCHARGE CONDUIT
22" penstock covered

b. Condition of System penstock inoperable, sedimented over princ. spillway conduit INTAKE full of debris.

c. Discharge from Drainage System penstock leakage

4) Instrumentation (Monumentation/Surveys, Observation Wells, Weirs, Piezometers, Etc.)

None

93-15-3(9/80)

5) Reservoir

a. Slopes shallow, stable

b. Sedimentation over lower penstock intake.

c. Unusual Conditions Which Affect Dam Normally no storage

6) Area Downstream of Dam

a. Downstream Hazard (No. of Homes, Highways, etc.) No immediate — but ~~the~~ with confined channel leads directly through homes & into Waterto

b. Seepage, Unusual Growth debris.

c. Evidence of Movement Beyond Toe of Dam —

d. Condition of Downstream Channel good.

7) Spillway(s) (Including Discharge Conveyance Channel)

good condition, removal of debris necessary

a. General good.

b. Condition of Service Spillway good.

c. Condition of Auxiliary Spillway N/A

d. Condition of Discharge Conveyance Channel N/A

8) Reservoir ~~Drain~~/Outlet princ. spillway drains res.

Type: Pipe ✓ Conduit _____ Other _____

Material: Concrete _____ Metal ✓ Other _____

Size: 22" Length 1200'

Invert Elevations: Entrance _____ Exit _____

Physical Condition (Describe): Unobservable _____

Material: poor

Joints: poor Alignment _____

Structural Integrity: poor

Hydraulic Capability: intake plugged

Means of Control: Gate ✓ Valve _____ Uncontrolled _____

Operation: Operable _____ Inoperable ✓ Other _____

Present Condition (Describe): should be removed.

9) Structural

a. Concrete Surfaces good - [redacted]

b. Structural Cracking some cracking

c. Movement - Horizontal & Vertical Alignment (Settlement) None

d. Junctions with Abutments or Embankments good.

e. Drains - Foundation, Joint, Face debris removal

f. Water Passages, Conduits, Sluices

g. Seepage or Leakage penstock / should be removed

h. Joints - Construction, etc. should be cleaned & recaulked

i. Foundation Appearently good - founded on bedrock

j. Abutments good

k. Control Gates None

l. Approach & Outlet Channels upstream - heavy sediment, brush
d/stream - debris, brush

m. Energy Dissipators (Plunge Pool, etc.) None

n. Intake Structures sediment & debris

o. Stability good.

p. Miscellaneous —

10) Appurtenant Structures (Power House, Lock, Gatehouse, Other)

a. Description and Condition INTAKE to spillway clogged w/ debris

structure overall – good shape

11) Operation Procedures (Lake Level Regulation):

No operation req'd.

0.0 AC-FT. STORAGE

APPENDIX C

HYDROLOGIC/HYDRAULIC

ENGINEERING DATA AND COMPUTATIONS

CHECK LIST FOR DAMS
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

AREA-CAPACITY DATA:

	Elevation (ft.)	Surface Area (acres)	Storage Capacity (acre-ft.)
1) Top of Dam	111.5	8.5	53.0
2) Design High Water (Max. Design Pool)	—	—	—
3) Auxiliary Spillway Crest	106.0	7.0	@ 30.0
4) Pool Level with Flashboards	—	—	—
5) Service Spillway Crest	92.0	0.0	0.0

DISCHARGES

	Volume (cfs)
1) Average Daily	1-2.
2) Spillway @ Maximum High Water (low level + overflow)	3519.
3) Spillway @ Design High Water	—
4) Spillway @ Auxiliary Spillway Crest Elevation	57.
5) Low Level Outlet	57.
6) Total (of all facilities) @ Maximum High Water	3519.
7) Maximum Known Flood	—
8) At Time of Inspection	~ 1.

CREST: ELEVATION: 111.5

Type: Reinforced Concrete Slab.

Width: ~20" AVE. Length: total (incl. overflow) 108.'

Spillover 70.3'

Location to left of center

SPILLWAY:

SERVICE		AUXILIARY
92.0	Elevation	106.
24" orifice into 48" conduit thru slab.	Type	ogee overflow crest
	Width	70.3'
	Type of Control	
✓	Uncontrolled	✓
	Controlled:	
—	Type (Flashboards; gate)	—
—	Number	—
—	Size/Length	—
	Invert Material	Concrete
	Anticipated Length of operating service	continuous.
Conduit length of 10.'	Chute Length	None
0.0'	Height Between Spillway Crest & Approach Channel Invert (Weir Flow)	1.3 H : 1V. slope (20')

HYDROMETEROLOGICAL GAGES:

Type : None

Location: —

Records:

Date - —

Max. Reading - —

FLOOD WATER CONTROL SYSTEM:

Warning System: None

Method of Controlled Releases (mechanisms):

No operation : 1) orifice, open, Normal/Stor. = 0.
2) uncontrolled overflow section.

DRAINAGE AREA: 3.04 miles ^{2}

DRAINAGE BASIN RUNOFF CHARACTERISTICS:

Land Use - Type: Some development

Terrain - Relief: moderate with defined channels

Surface - Soil: silts, clays, low perm, rock outcrops.

Runoff Potential (existing or planned extensive alterations to existing (surface or subsurface conditions)

No immediate changes taking place but probable complete development of the basin IN future.

Potential Sedimentation problem areas (natural or man-made; present or future)

Some sediment and debris problem evident but normal maintenance could eliminate problem.

Potential Backwater problem areas for levels at maximum storage capacity including surcharge storage:

few homes local but no increase in flooding due to dam during extreme event.

Dikes - Floodwalls (overflow & non-overflow) - Low reaches along the Reservoir perimeter:

Location: None

Elevation: _____

Reservoir:

Length @ Maximum Pool 900' ~~(Miles)~~

Length of Shoreline (@ Normal Spillway Crest) 0.0' (No impound) ~~(Miles)~~

AVX. 2000.'

WATERVLIET UPPER & LOWER DAMS.

UPPER DA = 2.33 mi²
1346 AC

$$L = \frac{7.6''(24000)}{12(5280)} = 2.88 \text{ mi.}$$

$L_{ca} = 3.3'' \quad = 1.25$
$C_t = 2.0 \rightarrow 1.6$ some urbanization
$t_p = C_t(L \times L_{ca})^{0.3} = 2.35$ hr
$t_r = 0.43$ hr say 0.40 hr.

$T_p = t_p + .5t_r = 2.35 + 0.20 = 2.55$ hr.

$C_p = 0.625$

SPILLWAY CAPACITY { 24" ORIFICE thru TOWER floor $A = 3.14$ FT.²
STORAGE CAPACITY { 19" SIPHON low level INLET to TOWER/conduit

Crest el. 143 Cassoulet -.60 $Q = CA\sqrt{2gh}$

ELEVATION	Q TOTAL (cfs)	C	h	STORAGE (AC.FT)
145	20.	.6	2	7
150	91.	↓	7	10.3
155	119.		12	19.4
160	140		17	28.7
170	178.		27	64.3
180	203.		37	128.6
190	226		47	251.4
200	250		57	507.3
210	267.		67	980.3

TOP OF DAM ELEV. 215.0' L = 500.' C = 3.0

WATERLIET UPPER & LOWER

LOWER DA = 102 ACRES
= 0.16 mi²

$L = 20'' \left(\frac{24000}{(12)5280}\right) = 0.75$ mi

$L_{ca} = 0.65'' \left(\frac{24000}{(12)5280}\right) = 0.25$ mi.

$C_t = 2.0$

$t_p = 1.2$ hr

$t_r = 0.2$ hr $\quad T_p = t_p + .5t_r = 1.3$ hr.

$C_p = 0.625$

DISCHARGE CAPACITY

STORAGE CAPACITY

TOP OF DAM ELEV. = 111.5 C = 3.2

SPILLCREST = 106.0 L = 70.3'

h = 5.5 ogee section & C = 3.6

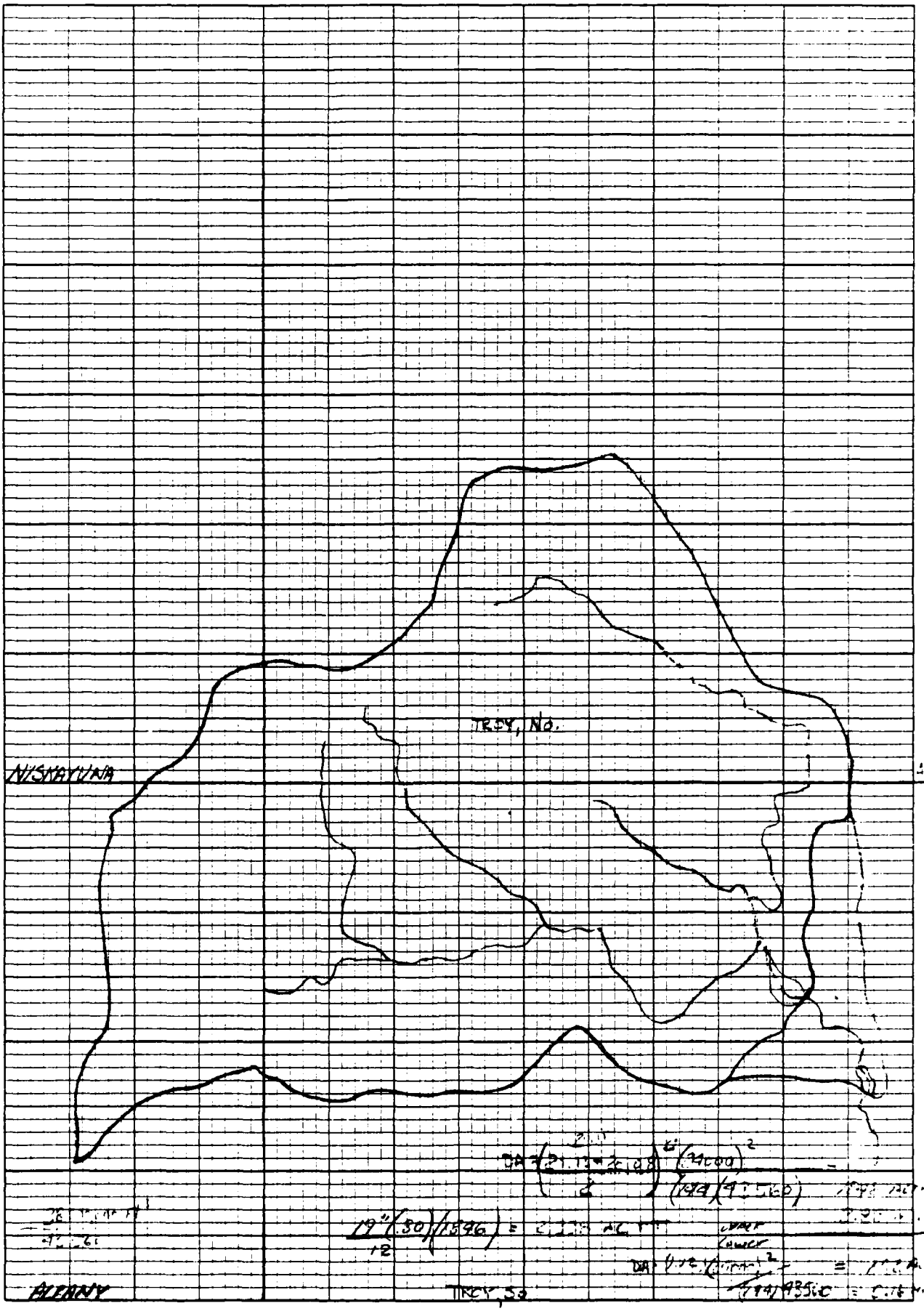
TOTAL abutment L@111.5 = 22.5 + 15.5 = 38'

reservoir filled w/ sediment to elevation 92 / 24" ORIFICE 3.14 sq ft C=.6

ELEVATION	h_{or}'	h_v'	Q cfs ORIFICE	Q cfs OVERFLOW	Q cfs TOTAL	STORAGE ac-ft 10^6 ft³	STORAGE ac-ft ac-ft	STORAGE ac-ft ACTUAL
85								
90	-	-	-	use 70.0 for end contr.		.19	4.4	Sediment 0
92	-	-	-			.40	9.2	Sediment 0
94	2	-	21.	-	21	.48	11.0	1.8
96	4	-	30.	-	30	.58	13 3	4.1
98	6	-	37.		37	.72	16.5	7.3
100	8	-	43.	-	43	.90	20.7	11 5
102	10	-	48.	-	48	1.12	25.7	16.5
104	12	-	53.	-	53	1.37	31.5	22.3
106	14	-	57	-	57	1.66	38.1	28.9
108	16	2	60.	713	773	2.01	46.1	36.9
110	18	4	64.	2016	2080	2 42	55.6	46.4
115	23	9	72.	6504	6577	3 45	79.2	70.0

RAINFALL Σ PMP = 20.55

Dur.	6	12	24	48
%	111	123	153	192



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**********                                                    **********
FLOOD HYDROGRAPH PACKAGE (HEC-1)                              NEW YORK STATE
DAM SAFETY VERSION     JULY 1978                              DEPT OF ENVIRONMENTAL CONSERVATION
  LAST MODIFICATION  26 FEB 79                                FLOOD PROTECTION BUREAU
  MODIFIED FOR HONEYWELL APR 79
**********                                                    **********
```

```
    1          Ai  INFLOW -OUTFLOW UPPER RESERVOIR
    2          A2  WATERVLIET STORM DETENTION
    3          A3  8DEC1980
    4          B    200       0      15       0       0       0       0       0       0       0
    5          Bi     5
    6          J      1       6       1
    7          Ji    .2      .4      .5      .6      .8       1
    8          K              1                       2               1
    9          Ki  INFLOW FROM SUB-BASIN
   10          M      1       1    2.88            2.96
   11          P             20.5     111     123     133     142
   12          T                                                1.0     0.1
   13          W    2.55    .625
   14          X     -2       2       1
   15          K      1       1                       2               1
   16          Ki  ROUTED HYDROGRAPH AT UPPER RESERVOIR
   17          Y                               1       1
   18          Yi     1                                        -143      -1
   19          Y4   143     145     150     155     160     170     180     190     200     210
   20          Y5             20      91     119     140     178     203     226     258     267
   21          $S              7    10.3    18.4    28.7    64.3   128.6   251.4   507.3   980.3
   22          $E   143     145     150     155     160     170     180     190     200     210
   23          $$   143
   24          $D   215       3     1.5     500
   25          K      0       2                                       1
   26          Ki  INFLOW FROM LOWER SUBBASIN
   27          M      1       1     .16            2.96
   28          P             20.5     111     123     133     142
   29          T                                                1.0     0.1
   30          W    1.3    .625
   31          X     -2       2       1
```

```
33              K      1       3                                       1
34              KI  RCUTE TOTAL RUNOFF THROUGH LOWER RESERVOIR
35              Y                               1       1
36              Y1     1                                        -92.    -1
37              Y4     92      94      96      98      100     102     104     106     108     110
38              Y4     115
39              Y5             21      30      37      43      48      53      57      773     2080
40              Y5     6877
41              $S             1.8     4.1     7.3     11.5    16.5    22.3    28.9    36.9    46.4
42              $S     70.0
43              $E     92      94      96      98      100     102     104     106     108     110
44              $E     115
45              $$     92
46              $D     111.5   3.2     1.5     38
47              K      99
48              A
49              A
50              A
51              A
52              A
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT	1
ROUTE HYDROGRAPH TO	1
RUNOFF HYDROGRAPH AT	2
COMBINE 2 HYDROGRAPHS AT	3
ROUTE HYDROGRAPH TO	3

END OF NETWORK

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**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION     JULY 1978
  LAST MODIFICATION  26 FEB 79
  MODIFIED FOR HONEYWELL APR 79
**********************************

**********************************
NEW YORK STATE
DEPT OF ENVIRONMENTAL CONSERVATION
FLOOD PROTECTION BUREAU
**********************************

RUN  DATE 12/08/80

                    INFLOW -OUTFLOW UPPER RESERVOIR

                    8DEC1980

                              JOB SPECIFICATION
      NC      NHR     NMIN     IDAY      IHR     IMIN    METRC     IPLT     IPRT    NSTAN
     200        0       15        0        0        0        0        0        0        0
                              JOPER      NWT    LROPT    TRACE
                                  5        0        0        0


                          MULTI-PLAN ANALYSES TO BE PERFORMED
                              NPLAN= 1 NRTIO= 6 LRTIO= 1
          RTIOS=   0.20   0.40   0.50   0.60   0.80   1.00


**********          **********          **********          **********          **********

                              SUB-AREA RUNOFF COMPUTATION

          INFLOW FROM SUB-BASIN
                        ISTAQ   ICOMP   IECON   ITAPE   JPLT    JPRT   INAME  ISTAGE   IAUTO
                            1       0       0       0       2       0       1       0       0

                                  HYDROGRAPH DATA
          IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO  ISNOW   ISAME   LOCAL
              1       1    2.88      0.    2.96      0.      0.         0       0       0

                                    PRECIP DATA
                        SPFE     PMS      R6     R12     R24     R48     R72     R96
                          0.   20.50  111.00  123.00  133.00  142.00    0.      0.
TRSPC COMPUTED BY THE PROGRAM IS 0.800

                                    LOSS DATA
                    LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
                        0      0.      0.    1.00      0.      0.    1.00    1.00    0.10      0.      0.

                                UNIT HYDROGRAPH DATA
                            TP=  2.55    CP=0.63    NTA=  0

                                RECESSION DATA
                            STRTQ=   -2.00    QRCSN=    2.00    RTIOR= 1.00
APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC=11.21 AND R= 9.39 INTERVALS

                UNIT HYDROGRAPH 56 END-OF-PERIOD ORDINATES, LAG=  2.54 HOURS, CP= 0.63  VOL= 1.00
          14.     53.    107.    169.    237.    307.    371.    420.    454.    470.
         468.    440.    396.    356.    320.    288.    259.    233.    209.    188.
         169.    152.    137.    123.    110.     99.     89.     80.     72.     65.
          58.     52.     47.     42.     38.     34.     31.     28.     25.     22.
          20.     18.     16.     15.     13.     12.     11.     10.      9.      8.
           7.      6.      6.      5.      5.      4.

          0                             END-OF-PERIOD FLOW
       MO.DA   HR.MN  PERIOD    RAIN    EXCS    LOSS      COMP Q       MO.DA   HR.MN  PERIOD    RAIN    EXCS    LOSS     COMP Q
        1.01    0.15       1    0.00      0.    0.00          6.        1.02    1.15     101    0.03    0.00    0.03         14.
```

1.01	0.45	3	0.00	0.	0.00	6.	1.02	1.45	103	0.03	0.00	0.03	14.
1.01	1.00	4	0.00	0.	0.00	6.	1.02	2.00	104	0.03	0.00	0.03	14.
1.01	1.15	5	0.00	0.	0.00	6.	1.02	2.15	105	0.03	0.00	0.03	15.
1.01	1.30	6	0.00	0.	0.00	6.	1.02	2.30	106	0.03	0.00	0.03	16.
1.01	1.45	7	0.00	0.	0.00	6.	1.02	2.45	107	0.03	0.00	0.03	16.
1.01	2.00	8	0.00	0.	0.00	6.	1.02	3.00	108	0.03	0.00	0.03	17.
1.01	2.15	9	0.00	0.	0.00	6.	1.02	3.15	109	0.03	0.00	0.03	18.
1.01	2.30	10	0.00	0.	0.00	6.	1.02	3.30	110	0.03	0.00	0.03	18.
1.01	2.45	11	0.00	0.	0.00	6.	1.02	3.45	111	0.03	0.00	0.03	19.
1.01	3.00	12	0.00	0.	0.00	6.	1.02	4.00	112	0.03	0.00	0.03	19.
1.01	3.15	13	0.00	0.	0.00	6.	1.02	4.15	113	0.03	0.00	0.03	20.
1.01	3.30	14	0.00	0.	0.00	6.	1.02	4.30	114	0.03	0.00	0.03	20.
1.01	3.45	15	0.00	0.	0.00	6.	1.02	4.45	115	0.03	0.00	0.03	20.
1.01	4.00	16	0.00	0.	0.00	6.	1.02	5.00	116	0.03	0.00	0.03	21.
1.01	4.15	17	0.00	0.	0.00	6.	1.02	5.15	117	0.03	0.00	0.03	21.
1.01	4.30	18	0.00	0.	0.00	6.	1.02	5.30	118	0.03	0.00	0.03	21.
1.01	4.45	19	0.00	0.	0.00	6.	1.02	5.45	119	0.03	0.00	0.03	21.
1.01	5.00	20	0.00	0.	0.00	6.	1.02	6.00	120	0.03	0.00	0.03	21.
1.01	5.15	21	0.00	0.	0.00	6.	1.02	6.15	121	0.08	0.06	0.03	22.
1.01	5.30	22	0.00	0.	0.00	6.	1.02	6.30	122	0.08	0.06	0.03	25.
1.01	5.45	23	0.00	0.	0.00	6.	1.02	6.45	123	0.08	0.06	0.03	31.
1.01	6.00	24	0.00	0.	0.00	6.	1.02	7.00	124	0.08	0.06	0.03	40.
1.01	6.15	25	0.01	0.	0.01	6.	1.02	7.15	125	0.08	0.06	0.03	53.
1.01	6.30	26	0.01	0.	0.01	6.	1.02	7.30	126	0.08	0.06	0.03	70.
1.01	6.45	27	0.01	0.	0.01	6.	1.02	7.45	127	0.08	0.06	0.03	91.
1.01	7.00	28	0.01	0.	0.01	6.	1.02	8.00	128	0.08	0.06	0.03	114.
1.01	7.15	29	0.01	0.	0.01	6.	1.02	8.15	129	0.08	0.06	0.03	139.
1.01	7.30	30	0.01	0.	0.01	6.	1.02	8.30	130	0.08	0.06	0.03	164.
1.01	7.45	31	0.01	0.	0.01	6.	1.02	8.45	131	0.08	0.06	0.03	190.
1.01	8.00	32	0.01	0.	0.01	6.	1.02	9.00	132	0.08	0.06	0.03	214.
1.01	8.15	33	0.01	0.	0.01	6.	1.02	9.15	133	0.08	0.06	0.03	236.
1.01	8.30	34	0.01	0.	0.01	6.	1.02	9.30	134	0.08	0.06	0.03	255.
1.01	8.45	35	0.01	0.	0.01	6.	1.02	9.45	135	0.08	0.06	0.03	273.
1.01	9.00	36	0.01	0.	0.01	6.	1.02	10.00	136	0.08	0.06	0.03	289.
1.01	9.15	37	0.01	0.	0.01	6.	1.02	10.15	137	0.08	0.06	0.03	303.
1.01	9.30	38	0.01	0.	0.01	6.	1.02	10.30	138	0.08	0.06	0.03	316.
1.01	9.45	39	0.01	0.	0.01	6.	1.02	10.45	139	0.08	0.06	0.03	327.
1.01	10.00	40	0.01	0.	0.01	6.	1.02	11.00	140	0.08	0.06	0.03	338.
1.01	10.15	41	0.01	0.	0.01	6.	1.02	11.15	141	0.08	0.06	0.03	347.
1.01	10.30	42	0.01	0.	0.01	6.	1.02	11.30	142	0.08	0.06	0.03	355.
1.01	10.45	43	0.01	0.	0.01	6.	1.02	11.45	143	0.08	0.06	0.03	363.
1.01	11.00	44	0.01	0.	0.01	6.	1.02	12.00	144	0.08	0.06	0.03	369.
1.01	11.15	45	0.01	0.	0.01	6.	1.02	12.15	145	0.46	0.43	0.02	381.
1.01	11.30	46	0.01	0.	0.01	6.	1.02	12.30	146	0.46	0.43	0.02	406.
1.01	11.45	47	0.01	0.	0.01	6.	1.02	12.45	147	0.46	0.43	0.02	451.
1.01	12.00	48	0.01	0.	0.01	6.	1.02	13.00	148	0.46	0.43	0.02	518.
1.01	12.15	49	0.03	0.	0.03	6.	1.02	13.15	149	0.55	0.52	0.02	612.
1.01	12.30	50	0.03	0.	0.03	6.	1.02	13.30	150	0.55	0.52	0.02	734.
1.01	12.45	51	0.03	0.	0.03	6.	1.02	13.45	151	0.55	0.52	0.02	886.
1.01	13.00	52	0.03	0.	0.03	6.	1.02	14.00	152	0.55	0.52	0.02	1061.
1.01	13.15	53	0.04	0.	0.04	6.	1.02	14.15	153	0.68	0.66	0.02	1256.
1.01	13.30	54	0.04	0.	0.04	6.	1.02	14.30	154	0.68	0.66	0.02	1469.
1.01	13.45	55	0.04	0.	0.04	6.	1.02	14.45	155	0.68	0.66	0.02	1694.
1.01	14.00	56	0.04	0.	0.04	6.	1.02	15.00	156	0.68	0.66	0.02	1921.
1.01	14.15	57	0.05	0.	0.05	6.	1.02	15.15	157	0.69	0.67	0.02	2144.
1.01	14.30	58	0.05	0.	0.05	6.	1.02	15.30	158	1.38	1.36	0.03	2374.
1.01	14.45	59	0.05	0.	0.05	6.	1.02	15.45	159	3.87	3.85	0.03	2661.
1.01	15.00	60	0.05	0.	0.05	6.	1.02	16.00	160	0.97	0.94	0.02	3032.
1.01	15.15	61	0.05	0.	0.05	6.	1.02	16.15	161	0.64	0.61	0.02	3455.
1.01	15.30	62	0.09	0.	0.09	6.	1.02	16.30	162	0.64	0.61	0.02	3900.
1.01	15.45	63	0.26	0.03	0.23	6.	1.02	16.45	163	0.64	0.61	0.02	4350.
1.01	16.00	64	0.07	0.04	0.03	8.	1.02	17.00	164	0.64	0.61	0.02	4788.
1.01	16.15	65	0.04	0.02	0.03	12.	1.02	17.15	165	0.50	0.48	0.02	5176.
1.01	16.30	66	0.04	0.02	0.03	17.	1.02	17.30	166	0.50	0.48	0.02	5481.

1.01	17.15	69	0.03	0.01	0.03	51.	1.02	18.15	169	0.04	0.02	0.03	5828.
1.01	17.30	70	0.03	0.01	0.03	50.	1.02	18.30	170	0.04	0.02	0.03	5701.
1.01	17.45	71	0.03	0.01	0.03	59.	1.02	18.45	171	0.04	0.02	0.03	5481.
1.01	18.00	72	0.03	0.01	0.03	67.	1.02	19.00	172	0.04	0.02	0.03	5227.
1.01	18.15	73	0.00	0.	0.00	73.	1.02	19.15	173	0.04	0.02	0.03	4949.
1.01	18.30	74	0.00	0.	0.00	77.	1.02	19.30	174	0.04	0.02	0.03	4648.
1.01	18.45	75	0.00	0.	0.00	79.	1.02	19.45	175	0.04	0.02	0.03	4327.
1.01	19.00	76	0.00	0.	0.00	78.	1.02	20.00	176	0.04	0.02	0.03	3996.
1.01	19.15	77	0.00	0.	0.00	77.	1.02	20.15	177	0.04	0.02	0.03	3663.
1.01	19.30	78	0.00	0.	0.00	73.	1.02	20.30	178	0.04	0.02	0.03	3335.
1.01	19.45	79	0.00	0.	0.00	69.	1.02	20.45	179	0.04	0.02	0.03	3020.
1.01	20.00	80	0.00	0.	0.00	65.	1.02	21.00	180	0.04	0.02	0.03	2728.
1.01	20.15	81	0.00	0.	0.00	60.	1.02	21.15	181	0.04	0.02	0.03	2464.
1.01	20.30	82	0.00	0.	0.00	55.	1.02	21.30	182	0.04	0.02	0.03	2228.
1.01	20.45	83	0.00	0.	0.00	50.	1.02	21.45	183	0.04	0.02	0.03	2015.
1.01	21.00	84	0.00	0.	0.00	46.	1.02	22.00	184	0.04	0.02	0.03	1824.
1.01	21.15	85	0.00	0.	0.00	42.	1.02	22.15	185	0.04	0.02	0.03	1652.
1.01	21.30	86	0.00	0.	0.00	38.	1.02	22.30	186	0.04	0.02	0.03	1497.
1.01	21.45	87	0.00	0.	0.00	35.	1.02	22.45	187	0.04	0.02	0.03	1358.
1.01	22.00	88	0.00	0.	0.00	32.	1.02	23.00	188	0.04	0.02	0.03	1233.
1.01	22.15	89	0.00	0.	0.00	29.	1.02	23.15	189	0.04	0.02	0.03	1121.
1.01	22.30	90	0.00	0.	0.00	27.	1.02	23.30	190	0.04	0.02	0.03	1020.
1.01	22.45	91	0.00	0.	0.00	25.	1.02	23.45	191	0.04	0.02	0.03	929.
1.01	23.00	92	0.00	0.	0.00	23.	1.03	0.	192	0.04	0.02	0.03	848.
1.01	23.15	93	0.00	0.	0.00	21.	1.03	0.15	193	0.	0.	0.	774.
1.01	23.30	94	0.00	0.	0.00	20.	1.03	0.30	194	0.	0.	0.	707.
1.01	23.45	95	0.00	0.	0.00	18.	1.03	0.45	195	0.	0.	0.	646.
1.02	0.	96	0.00	0.	0.00	17.	1.03	1.00	196	0.	0.	0.	591.
1.02	0.15	97	0.03	0.00	0.03	16.	1.03	1.15	197	0.	0.	0.	539.
1.02	0.30	98	0.03	0.00	0.03	15.	1.03	1.30	198	0.	0.	0.	491.
1.02	0.45	99	0.03	0.00	0.03	14.	1.03	1.45	199	0.	0.	0.	446.
1.02	1.00	100	0.03	0.00	0.03	14.	1.03	2.00	200	0.	0.	0.	405.
									SUM	23.29	19.59	3.70	143113.
										(592.)	(498.)	(94.)	(4052.51)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5828.	4251.	1469.	714.	142890.
CMS	165.	120.	42.	20.	4046.
INCHES		13.73	18.97	19.23	19.23
MM		348.77	481.95	488.45	488.45
AC-FT		2108.	2913.	2952.	2952.
THOUS CU M		2600.	3593.	3642.	3642.

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 0.20	RATIO 2 0.40	RATIO 3 0.50	RATIO 4 0.60	RATIO 5 0.80	RATIO 6 1.00
HYDROGRAPH AT	1	2.88 (15091.13)	1	1166. (33.00)	2331. (66.01)	2914. (82.51)	3497. (99.01)	4662. (132.02)	5828. (165.02)
ROUTED TO	1	2.88 (15091.13)	1	241. (6.82)	265. (7.51)	270. (7.66)	1361. (38.54)	3588. (101.61)	5377. (152.25)
HYDROGRAPH AT	2	0.16 (15091.13)	1	92. (2.59)	183. (5.19)	229. (6.48)	275. (7.78)	366. (10.37)	458. (12.97)
2 COMBINED	3	3.04 (15091.13)	1	288. (8.14)	408. (11.55)	463. (13.12)	1380. (39.08)	3705. (104.91)	5629. (159.40)
ROUTED TO	3	3.04 (15091.13)	1	286. (8.11)	406. (11.49)	461. (13.05)	1373. (38.89)	3766. (106.64)	5827. (164.99)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	143.00	143.00	215.00
STORAGE	0.	0.	1217.
OUTFLOW	0.	0.	272.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.20	194.59	0.	369.	241.	0.	47.00	0.
0.40	207.98	0.	885.	265.	0.	48.75	0.
0.50	213.76	0.	1158.	270.	0.	49.25	0.
0.60	215.81	0.81	1255.	1361.	5.50	45.50	0.
0.80	216.70	1.70	1297.	3588.	7.25	43.75	0.
1.00	217.26	2.26	1324.	5377.	8.00	42.75	0.

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	92.00	92.00	111.50
STORAGE	0.	0.	53.
OUTFLOW	0.	0.	3519.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.20	106.64	0.	31.	286.	0.	41.25	0.
0.40	106.97	0.	33.	406.	0.	41.25	0.
0.50	107.13	0.	33.	461.	0.	41.25	0.
0.60	108.92	0.	41.	1373.	0.	45.50	0.
0.80	111.74	0.24	55.	3766.	0.75	43.50	0.
1.00	113.54	2.04	63.	5827.	2.00	42.75	0.

APPENDIX D

REFERENCES

APPENDIX D

REFERENCES

1) U.S. Department of Commerce, Technical Paper No. 40, Rainfall Frequency Atlas of the United States, May 1961.

2) U.S. Department of Commerce, Hydrometeorological Report No. 33, Seasonal Variation of the Probable Maximum Precipitation East of the 105th Meridian for Areas from 10 to 1,000 Square Miles and Durations of 6, 12, 24, and 48 Hours; April 1956.

3) Soil Conservation Service, National Engineering Handbook, Section 4, Hydrology, August 1972 (U.S. Department of Agriculture).

4) H.W. King and E.F. Brater, Handbook of Hydraulics, 5th edition, McGraw-Hill, 1963.

5) T.W. Lambe and R.V. Whitman, Soil Mechanics, John Wiley and Sons, 1965.

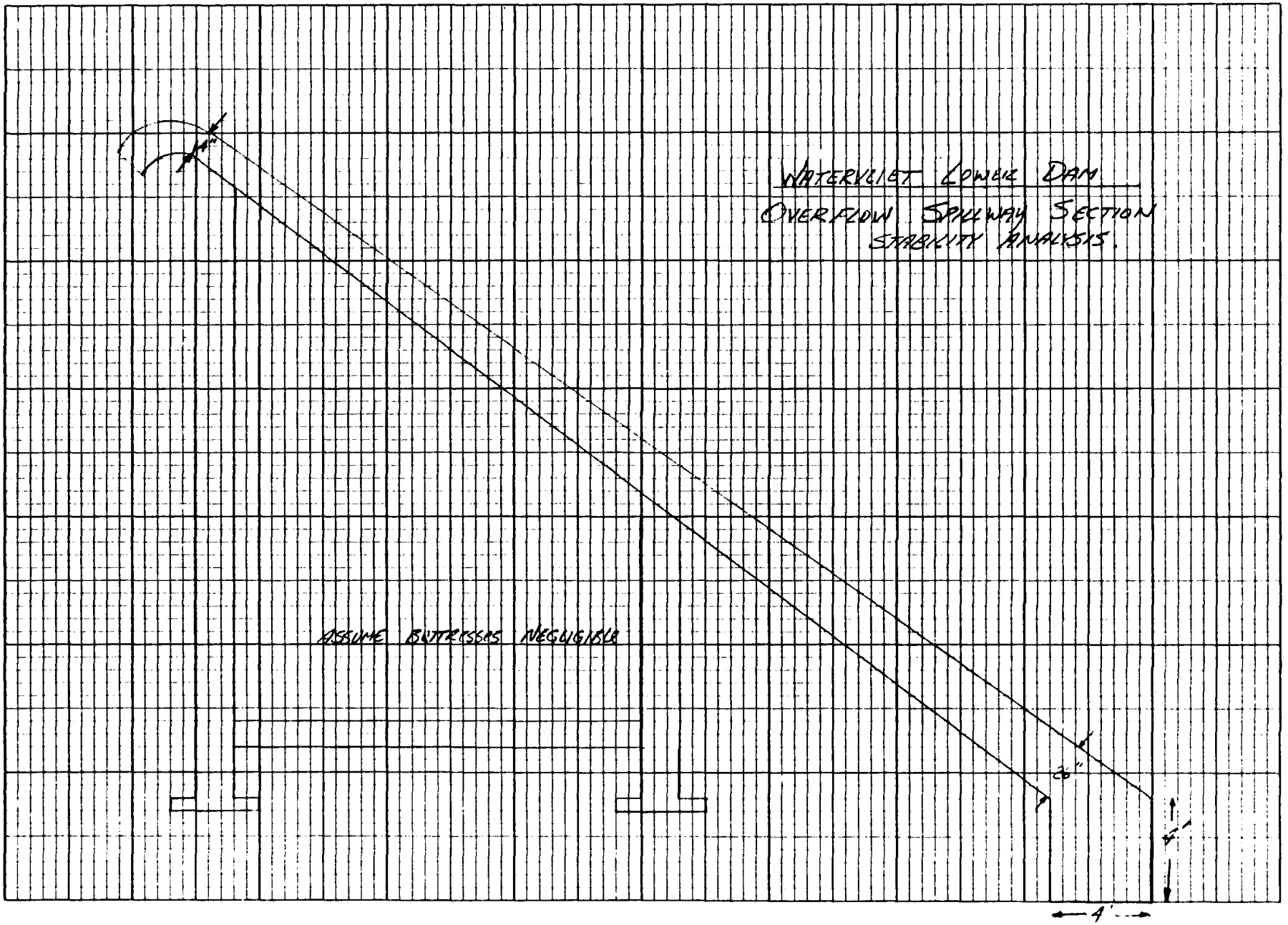
6) W.D. Thornbury, Principles of Geomorphology, John Wiley and Sons, 1969.

7) University of the State of New York, Geology of New York, Education Leaflet 20, Reprinted 1973.

8) Cornell University Agriculture Experiment Station (compiled by M.G. Cline and R.L. Marshall), General Soil Map of New York State and Soils of New York Landscapes, Information Bulletin 119, 1977.

APPENDIX E

STABILITY ANALYSIS



STABILITY ANALYSIS PROGRAM - WORK SHEET

INPUT ENTRY		ANALYSIS CONDITION 1	2	3	4	5
Unit Weight of Dam (K/ft^3)	0	0.15				
Area of Segment No. 1 (ft^2)	1	73.33				
Distance from Center of Gravity of Segment No. 1 to Downstream Toe (ft)	2	8.50				
Area of Segment No. 2 (ft^2)	3	200.10				
Distance from Center of Gravity of Segment No. 2 to Downstream Toe (ft)	4	29.67				
Area of Segment No. 3 (ft^2)	5	16.0				
Distance from Center of Gravity of Segment No. 3 to Downstream Toe (ft)	6	35.0				
Base Width of Dam (Total) (ft)	7	4. (cutoff)				
Height of Dam (ft)	8	26.0				
Ice Loading (K/L ft.)	9	0				
Coefficient of Sliding	10	0.7				
Unit Weight of Soil (K/ft^3) (deduct 18)	11	0.0				
Active Soil Coefficient - Ka	12	0.0				
Passive Soil Coefficient - Kp	13	0.0				
Height of Water over Top of Dam or Spillway (ft)	14	0.	1.0	7.5		
Height of Soil for Active Pressure (ft)	15	0.0				
Height of Soil for Passive Pressure (ft)	16	0.0				
Height of Water in Tailrace Channel (ft)	17	0.0	0.5	3.0		
Weight of Water (K/ft^3)	18	0.624				
Area of Segment No. 4 (ft^2)	19	—				
Distance from Center of Gravity of Segment No. 4 to Downstream Toe (ft)	20	—				
Height of Ice Load or Active Water (ft) (does not include 14)	46	26				
Seismic Coefficient (g)	50	0.0	0.0	0.1		
SHEAR KEY	58	39.47				

RESULTS OF ANALYSIS						
Factor of Safety vs. Overturning		5.370	4.835			
Distance From Toe to Resultant		20.825	20.329			
Factor of Safety vs. Sliding		3.205				

WATERVLIET LOWER DAM
STABILITY ANALYSIS
SPILLWAY SECTION

Case I Normal Loading

(a) 5.3899[illegible]149

(b) 20.824[illegible]167

(c) 3.2045[illegible]704

Case II 1/2 PMF

(a) 4.834[illegible]175

(b) 20.324[illegible]74

(c) 2.974-[illegible]

Case III PMF

(a) 2.936[illegible]248

(b) 17.040[illegible]62

(c) 2.032[illegible]127

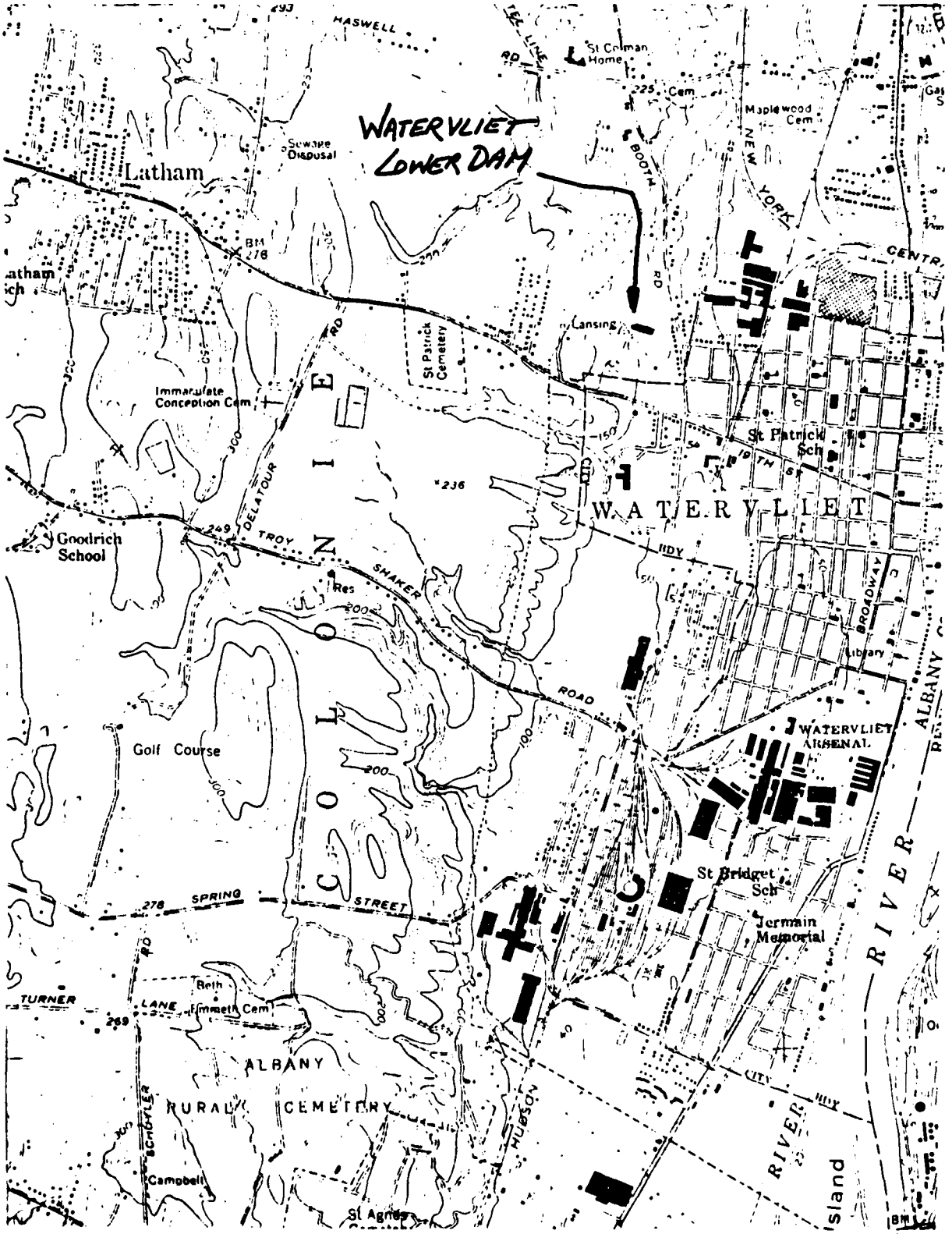
NOTE: (a) is the factor of safety for overturning;

(b) is the location of the resultant from the toe;

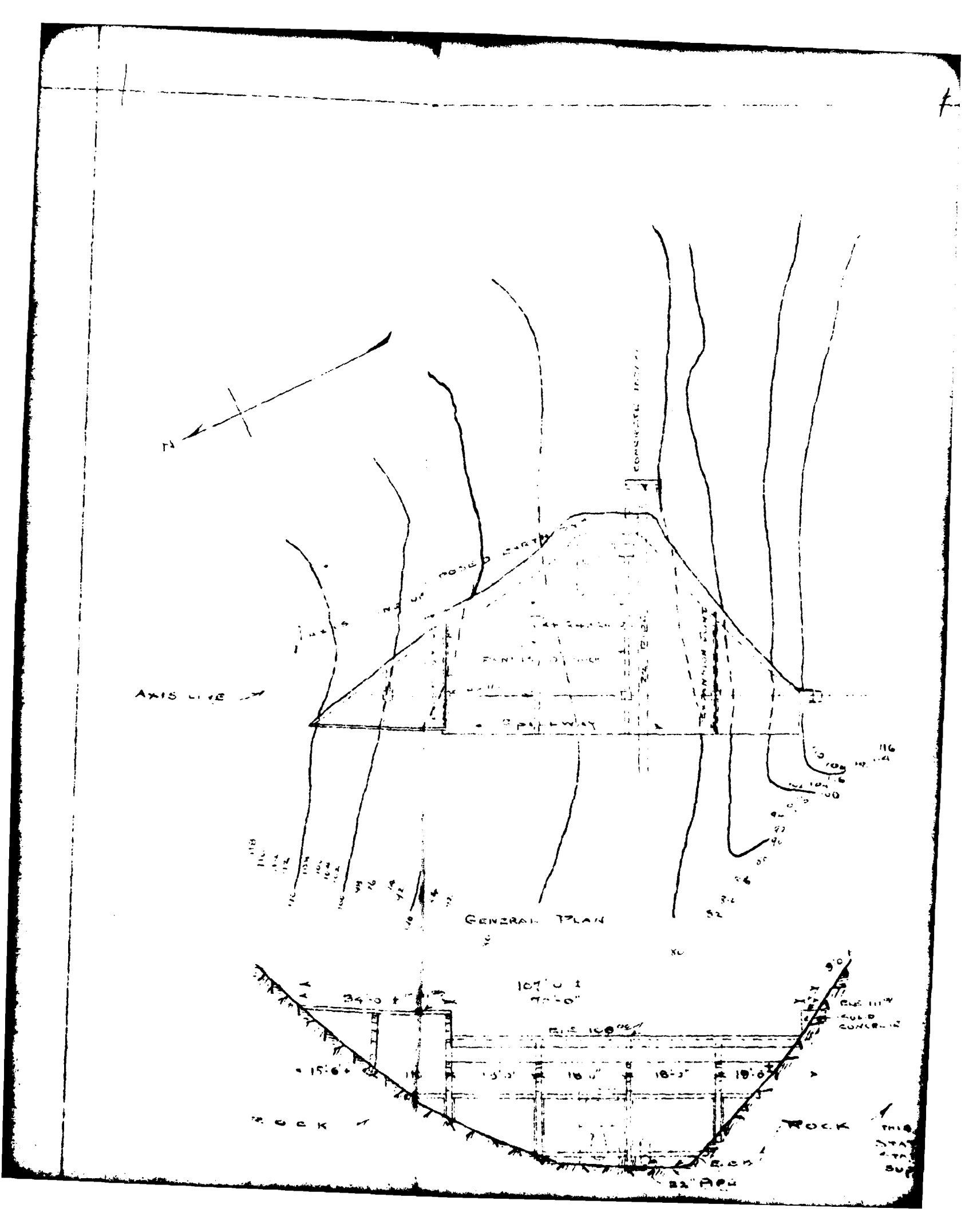
(c) is the factor of safety for sliding.

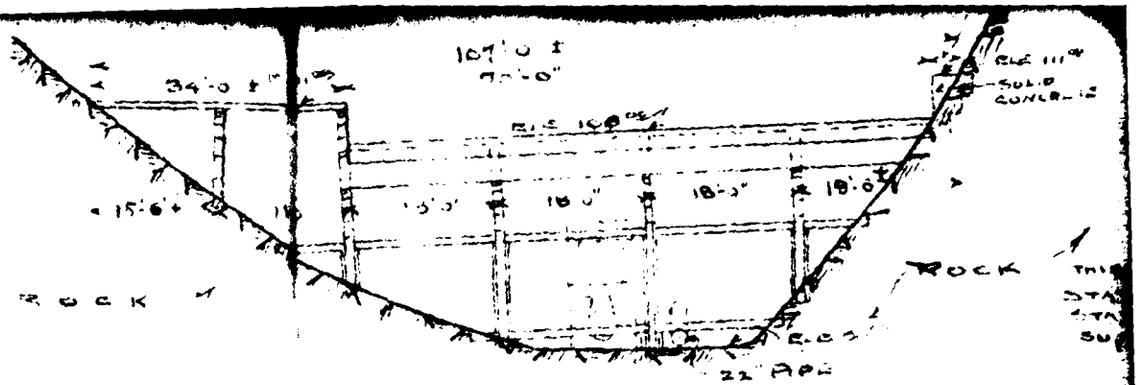
APPENDIX F

DRAWINGS



TOPOGRAPHIC MAP

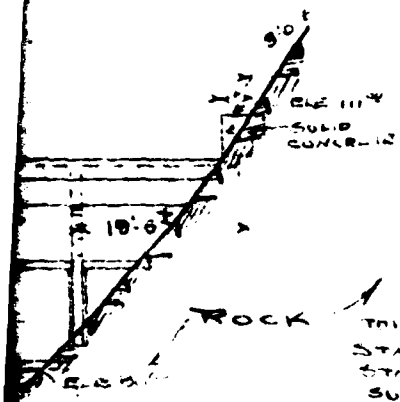

AXIS LINE
GENERAL PLAN
ROCK
ROCK



GENERAL ELEVATION

REINFORCED CONCRETE
STORM SEWER COMMISSION
DESIGN BY FRED M. HUDLEY
SCALE 1" = 20 ft SOLOMON

2



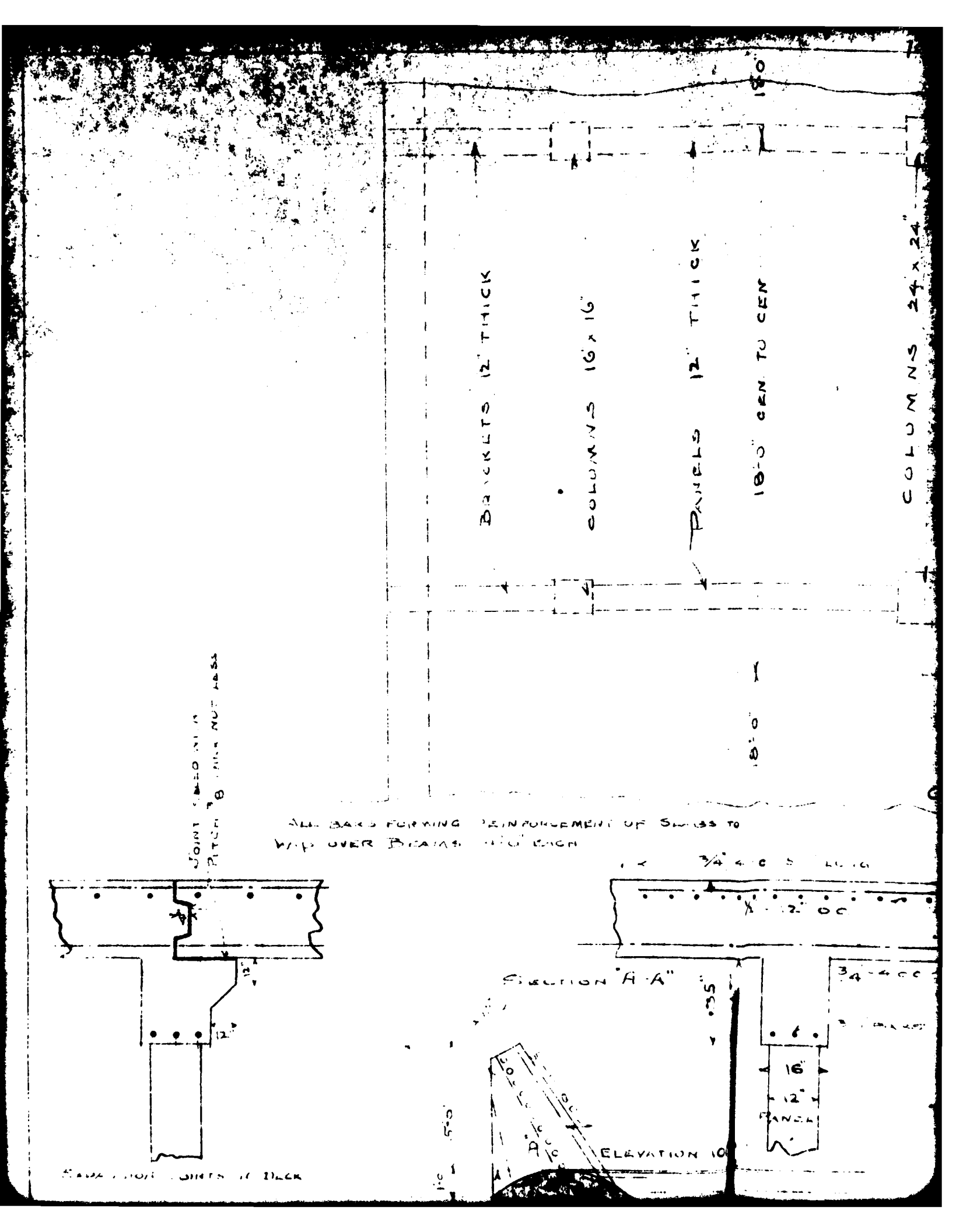
THIS DRAWING APPROVED BY
STATE CONSERVATION COMMISSION
STATE OF NEW YORK AND
SUPERSEDES ALL OTHERS

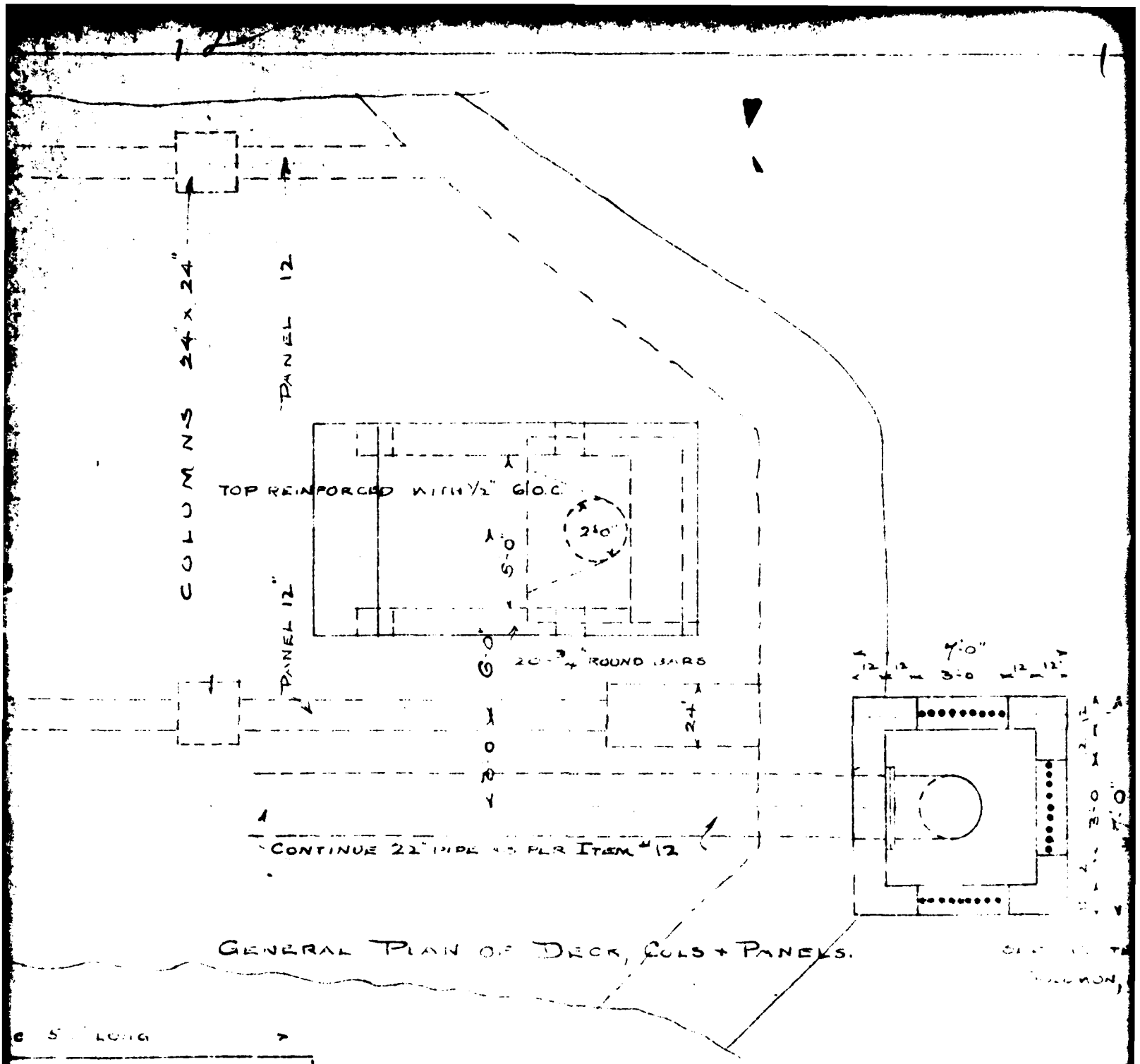
REVISED TO APRIL 6TH 1912

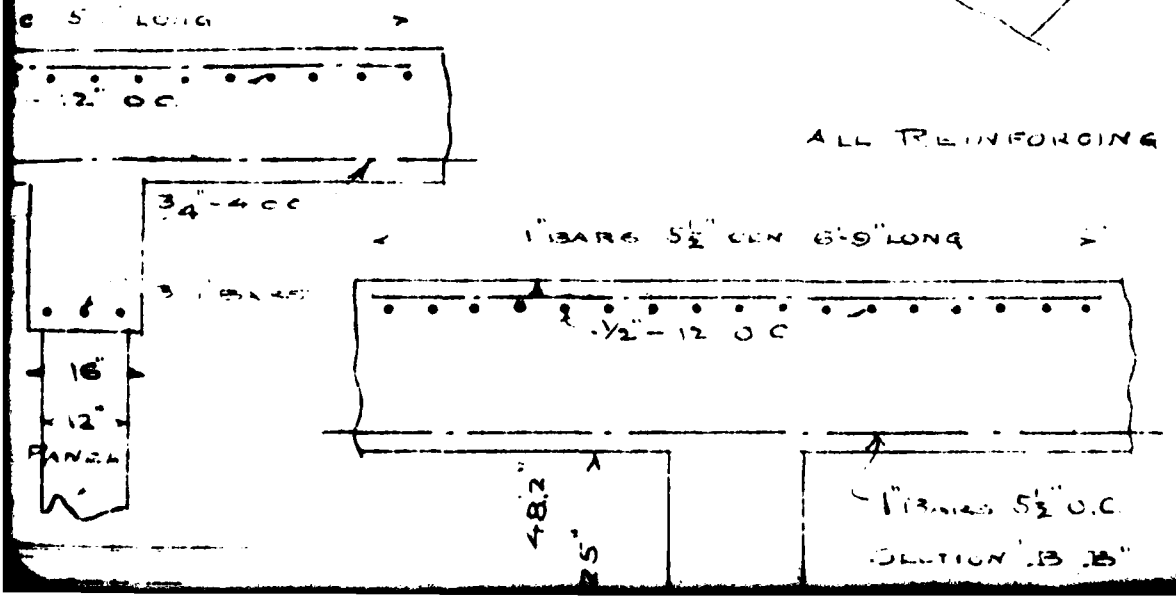
ELEVATION

REINFORCED CONCRETE DAM LOWER DAM SITE
STORM SEWER COMMISSION WATERVLIET N.Y
SIGN BY FRED M. HOADLEY CONSULTING ENGINEER WORCESTER MASS
ROSS & KEID ENGINEERS IN CHARGE WATERVLIET, N.Y

13

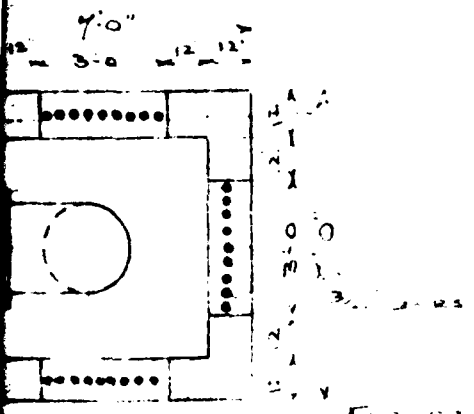

BRACKETS 12" THICK
COLUMNS 16 x 16
PANELS 12" THICK
18'-0" CEN TO CEN
COLUMNS 24" x 24"
ALL BARS FORMING REINFORCEMENT OF SLABS TO
SECTION "A-A"
ELEVATION





ALL REINFORCING BARS TO BE SQUARE

13

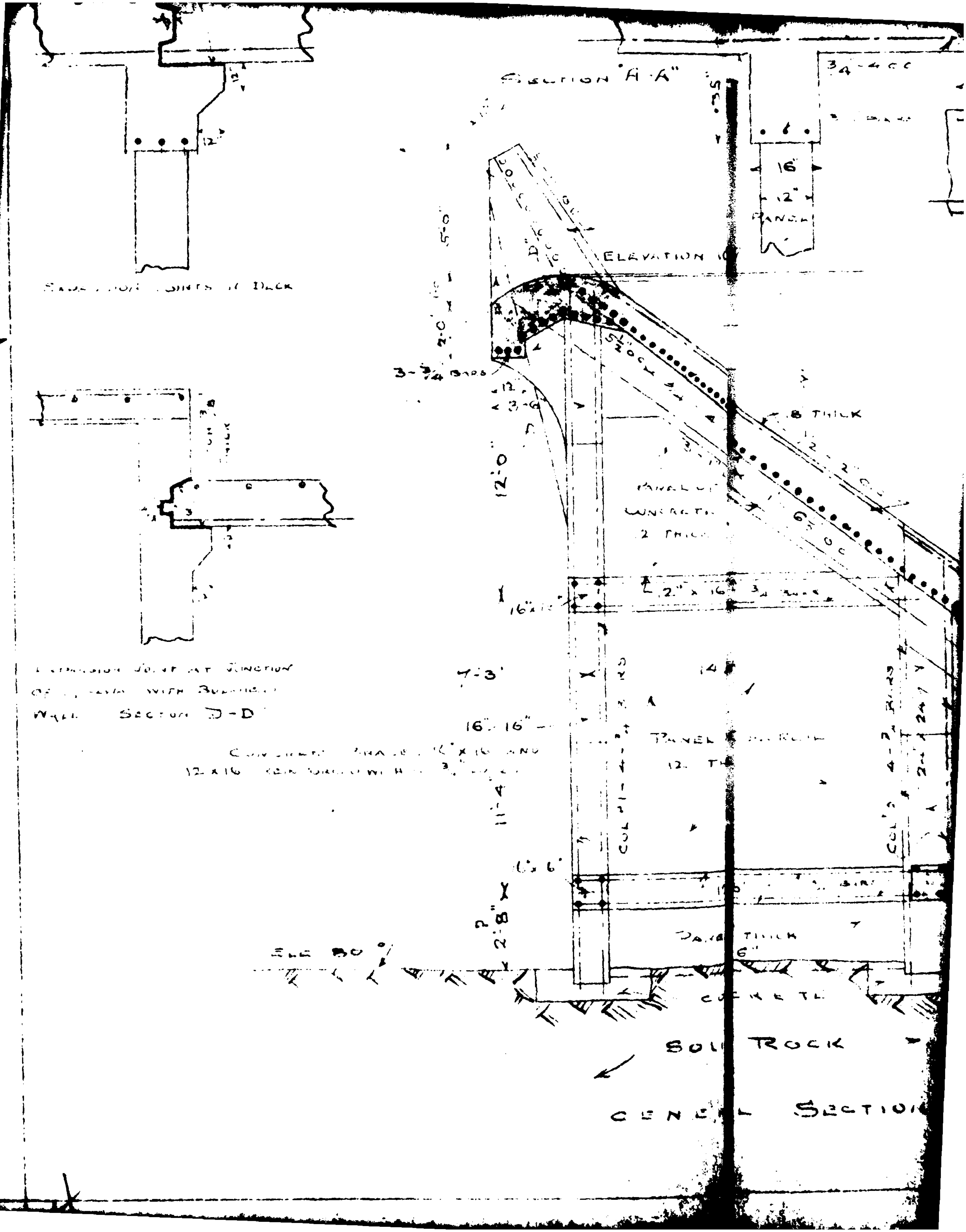


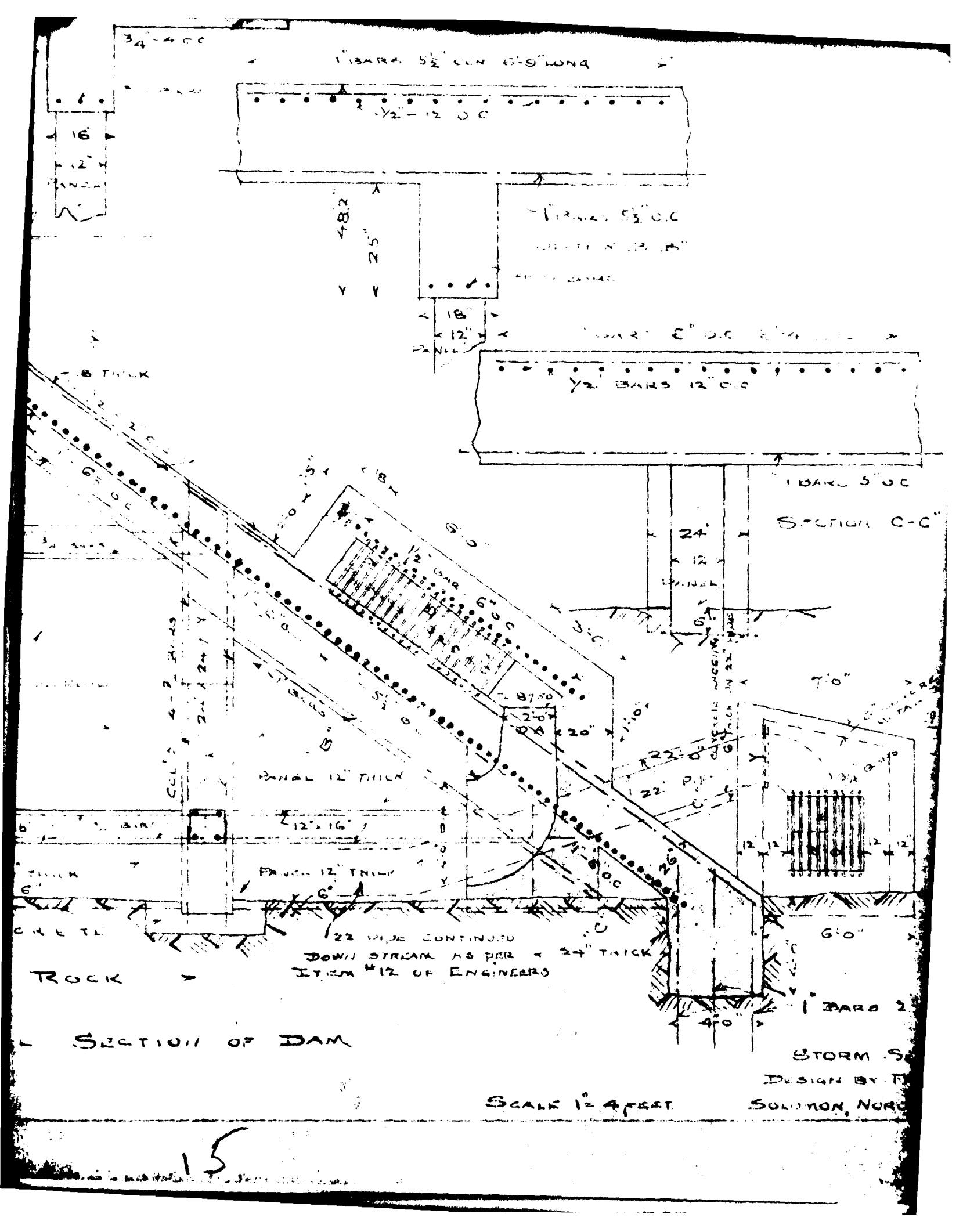
FOR OTHER DETAILS

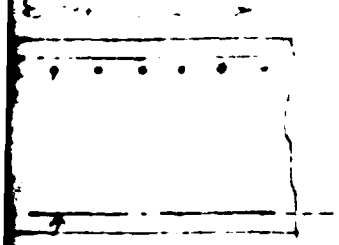
SEE [illegible]

SOLOMON, YORKE & KEIL ENGINEER

TO BE SQUARE "HAVAMEYER BARS"

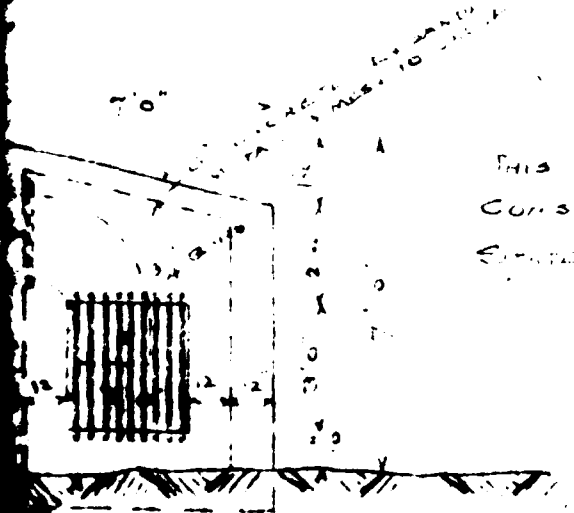

SECTION "A-A"
16"
12"
ELEVATION
3-3/4 BARS
8 THICK
12'-0"
7-3'
16"-16"
PANEL
2'-8"
ELE 80
SOIL ROCK
WALL SECTION D-D


SECTION C-C
SECTION OF DAM
TROCK
22 PIPE CONTINUED DOWN STREAM AS PER ITEM #12 OF ENGINEERS
PANEL 12" THICK
24" THICK
SCALE 1" = 4 FEET
DESIGN BY
SOLOMON, NURU
STORM S



1 BAR @ 5" O.C.

SECTION C-C



THIS DRAWING APPROVED BY STATE CONSERVATION COMMISSION OF N.Y. STATE AND SUPERCEDES ALL OTHERS

REVISED TO APRIL 11th 1912

1" Bars 2'-0" CEN. LENGTHWISE.

REINFORCED CONCRETE DAM FOR LOWER DAM SITE

STORM SEWER — SECTION WATERVLIET N.Y.

DRAWN BY: FRED N. — CONSULTING ENGINEERS

NORCROSS — 14 YEARS IN SYRACUSE